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PROJECT FOR THE NEW LOW AND MEDIUM ACTIVITY RADWASTE STORAGE INSTALLATIONS IN EL CABRIL

P. ZULOAGA

INTRODUCTION

On December 15, 1989, after obtaining the construction permit from the Ministry of Industry and Energy and the municipal site permit, the construction work began on the new low and medium activity radwaste storage installations in Sierra Albarrana, which ENRESA has called "El Cabril Storage Center" which is how this installation is known in the area.

El Cabril was a mining operation of the Junta de Energía Nuclear which began to be used as waste storage in 1961. Initially, the waste was deposited in a spent uranium mine, the Beta Mine. Later other buildings were used, such as the old thermal plant or "permanent depository". In 1982, three new wings or modules were commissioned, each with a capacity for storing 5,000 220-liter drums.

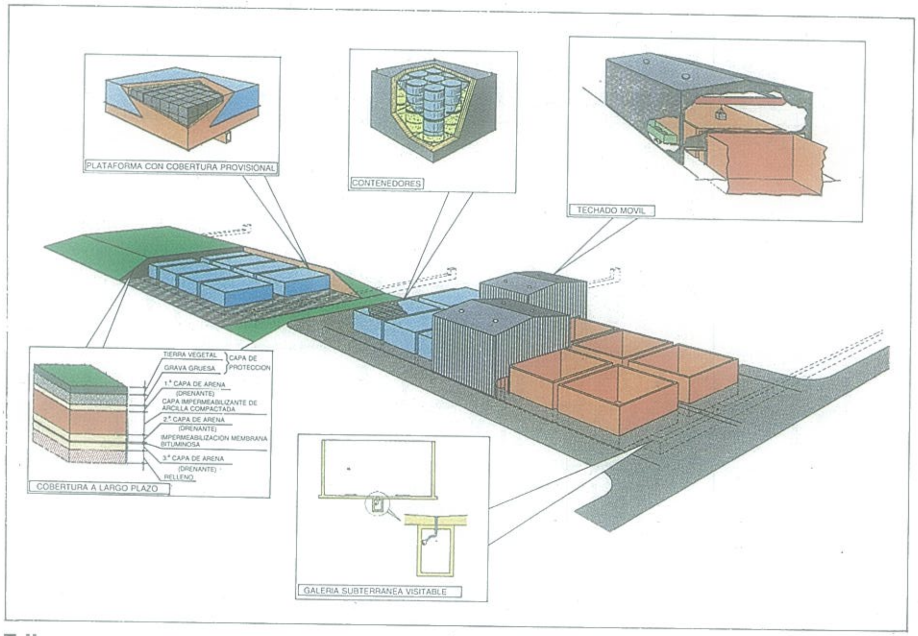
In January, 1986, ENRESA took over this installation. Up to May 1989, it only received waste conditioned in CIEMAT that came from this center or from radioactive installations. After this date, El Cabril began to store waste from nuclear power plants, specifically waste from the Garoña and Zorita NPP's.

Al present, all the waste in El Cabril has been transferred to the modules that, together with the auxiliary installations required for operation and surveillance, comprise the nuclear installation proper. Both the Beta Mine and the permanent depository have been declassified (fig. I Current installations).

PURPOSE OF THE NEW INSTALLATIONS

From a technical point of view, the new installations in El Cabril were designed to

F I *Storage Buildings.*



F II *Disposal Concept.*

provide long-term low and medium activity waste storage. For this purpose, they must fulfill two basic objectives:

- Ensure immediate and deferred protection of people and the environment.
- Immediate protection does not pose specific problems and is similar to that of other installations. Deferred protection is ensured by means of a multiple barrier system.
- Permit free use of the site after a maximum time period of 300 years with no radiological limitations. This maximum duration of 300 years is taken from the French regulations (RFS I-2) adopted as reference, and it corresponds to a period during which it can be reasonably ensured that contruction over the storage can be prevented and after which, as required by these regulations, it is assumed that all the artificial works will be totally degraded.

In addition, a basic objective of the El Cabril design has been the possible reclamation of the waste if the circumstances so advise. Even though this is always possible in a surface storage, the original design was substantially modified to introduce this concept.

With the adopted solution, the storage capacity is 35,000 m^3 of 0.216 m^3 drums, which corresponds to a reception capacity of 42,000 m^3 before the specified volume reduction of part of the waste.

Two requirements can be established on the basis of the above mentioned objectives:

- Insulating the waste packages from water, and
- limiting activity.

Together with man, water is the possible vehicle through which stored radioactivity is dispersed. Therefore, it is necessary to insulate the storage from underground water (locating the waste packages above the water table) and surface water (avoiding flood zones and low areas and protecting them from precipitation).

On the other hand, by assuming human intrusion after a maximum period of 300 years and formulating pessimistic hypotheses (for example, permanent housing or construction of large public works over the storage proper), the maximum total activity and mass activity must be limited so that impact of these hypotheses is acceptable. It should be emphasized that it is the intrusion scenario that limits the activity that can be stored in a surface or shallow storage system, and not the impact due to possible water drag that could infiltrate the waste, even assuming total degradation of the artificial barriers. These intrusion scenarios are practcally the same regardless of the selected site.

This limitation is what clearly separates the surface-storable, short-lived, medium and low activity waste from other categories that should be evacuated in depth. In addition, the center has the capacity for treating waste from small producers, reducing compactable waste volume, conditioning waste generated in the installation itself, and reconditioning the waste package storage units.

THE STORAGE SYSTEM

The waste packages, most of which are 0.22 m^3 drums, are stored inside concrete storage containers (fig. II). The drums are immobilized in the container, which is a 24-ton concrete block with outside dimensions of 2.25 × 2.25 ×2.20 m.

These containers are stacked inside the storage structures. Each one measures approximately 24 × 29 × 10 m on the outside and has capacity for 300 of these containers. The containers are placed next to each other, except in a center cross or band provided for absorbing fabrication or container tolerances.

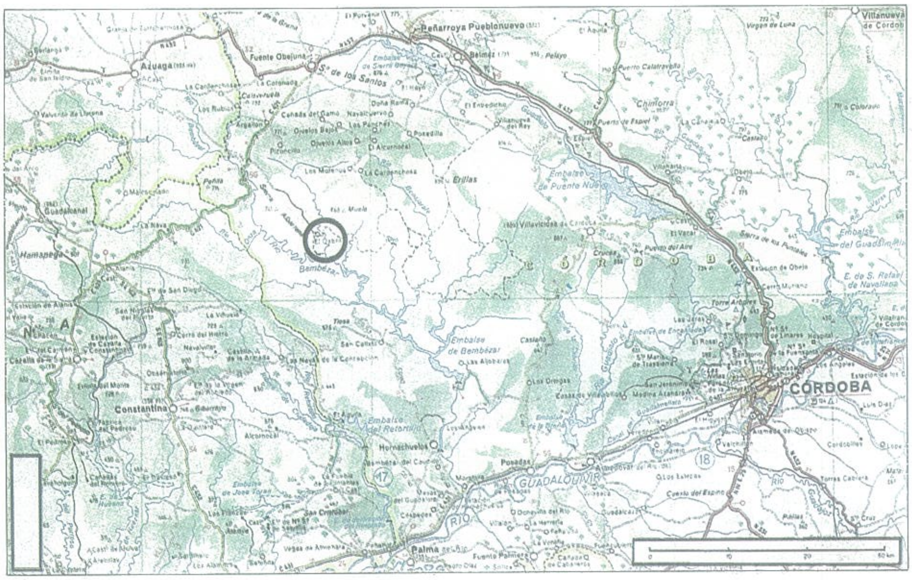
Once a storage structure operation is completed, counterlids are put into place to prevent the upper closure slab from sticking to the containers and to minimize the dose while the slab is being made. The central band is then filled in with gravel to stiffen the assembly and fill in gaps, and the upper closure slab is installed. The structure is then waterproofed with a synthetic cover. The lower plate is the primary storage structure component; its function is to collect any water that may have infiltrated and direct it to the infiltration control network (RCI). This network consists of a system of pipes that run through inspection galleries located below the storage structure. Each structure is connected to the network through a retaining tank; in the event that water collects in the control network, this tank serves to determine from which structure the water is coming in order to repair the cover (temporarily or long-term).

This piping network, which operates in a passive way, leads into a final control tank with a capacity for the infiltration collected in one year from rated cover infiltration plus hat corresponding to 100 m^2 of cover cave-in. Storage system operation can be properly supervised in this way, by detecting and determining the origin of abnormal quantities of infiltrated water and eventual water contamination.

During the exploitation phase, with the triple aim of protecting the waste containers from the environment, minimizing the water collected in the RCI and supporting maintenance operations, each row of storage structures is provided with a rail-mounted mobile roofing. This auxiliary roofing is located over the storage structure being used. After it is waterproofed, the roofing is moved to the adjacent structure.

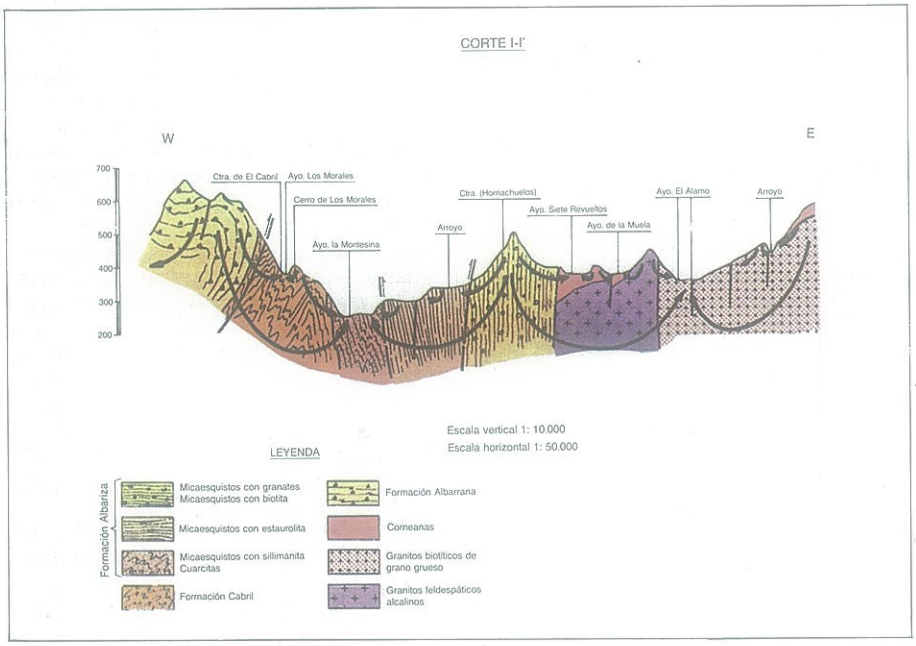
Once El Cabril has been completely filled, or at least one of the zones into which the storage is divided, the assembly can be covered with an impermeable cover consisting of alternating layers of waterproof drainage materials that provide long-term protection for the containers and ensure a long life for the containers proper. The multibarrier system, consisting of three barriers, is defined as follows:

- The first consists of the waste immobilization matrix and the isolating storage container waste.
- The second is formed by the lower



F III *Sites Location.*

F IV *Geological Cutting.*



structural plate, the cover and the infiltration control network, and it limits water access to the packages and controls the water that may come into contact with the packages and its eventual treatment, if necessary.

— The third is the geological barrier and consists of the surrounding land; it would limit the impact of a possible leaching in the event of an accident or on the assumption of total degradation of the first two barriers adopted for the free use phase.

THE SITE

El Cabril is located in a scarcely populated area in the Northeast part of the province of Córdoba about 130 km away from the capital. It belongs to the municipality of Hornachuelos. The main access exits from the Fuenteovejuna to Cazalla de la Sierra highway to the north of the installation (fig. III).

The site is located in the southern part of the central Iberian zone of the Iberian mountain mass, in an area with moderate seismic activity.

The new installations are being built in the northern part of El Cabril, next to the main access road. They are located in a geological formation of gneisses and micashale called the Cabril formation, the power of which is greater than 300 m.

The installation has been divided into two zones to adapt it to the topography.

The waste storage zone occupies the North slope of the Los Morales center and is the most suitable area for long-term storage. This zone is delimited by the La Montesina stream and its tributary, the Los Morales stream, which together form a peninsula. These streams control the hydrogeological operation of the storage; together with a bore network, they provide for radiological surveillance of the site (fig. IV).

The operation's auxiliary buildings are located on the slope of the main massif of Sierra Albarrana in the same geological formation, and are separated from the storage zone by the gulley of Los Morales stream.

GENERAL ARRANGEMENT BUILDING ZONE

Figure V shows the main installation arranged in order of their position with regard to the entrance:

INDUSTRIAL SAFETY BUILDING (1)

This building contains the access control, central surveillance station and fire fighting services.

ADMINISTRATION BUILDING (2)

CHARACTERIZATION BUILDING. INACTIVE BUILDING (7)

This building is provided for performing tests on inactive test samples with characteristics similar to those of the different types of bundles to be stored. It also houses the characterization laboratory personnel offices.

TECHNICAL SERVICE BUILDING (3)

The main equipment of the different auxiliary service systems are installed in this building: transformer station, electrical distribution, backup diesel, cooling and heating plants, water treatment plant, compressed air. It also houses the auxiliary service control panel.

MAINTENANCE BUILDING (4)

In addition to the mechanical, electrical and instrumentation workshops, this buildign contains the radiological control and vehicle decontamination stations. Together with the General Service Building, this buildign forms the separation between the unregulated zone, insofar as radiological protection is concerned, and the limited access zones.

GENERAL SERVICE BUILDING (5)

This building contains the radiological protection services, medical service, dressing rooms, laundry, environmental surveillance laboratory, chemical laboratory, and personnel access radiological control.

All personnel enter the limited access zone through this building, with the exception of vehicle drivers.

CONDITIONING BUILDING (6)

All treatment and conditioning operations described in the following paragraph are performed in this building (fig. VI). Practically all waste passes through this building (except for those that may be directly storable in the future). It also houses the Control Room, from which most of this building's systems and the storage zone maintenance equipment are operated and that centralizes operating information from the entire installation.

CHARACTERIZATION LABORATORY. ACTIVE BUILDING (8)

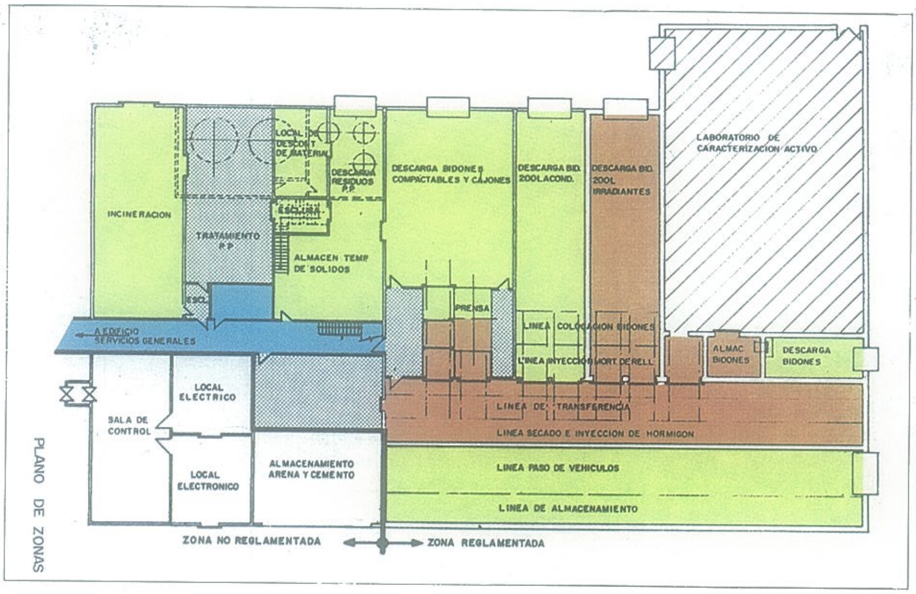
This building is for characterization testing of the types of packages with active test samples and actual packages, and for technically verifying some packages sent to the plant to check that they agree with the documents supplied during the characterization process.
Likewise, this building is provided for R&D work on active matrices. The laboratory is composed of:

- Sample preparation station.
- Leaching barrels.
- Transport testing station.
- Operating cells for test plate removal.

The laboratory is connected to the Conditioning Building to directly transfer waste generated therein.

STORAGE ZONE

A total of 28 storage structures are built in this zone, divided into two areas: the north platform with 16 structures, and the south platform with 12.
The initial plan was to build only four structures and to gradually build the others as the first ones were filled. However, in order to better direct the waste truck traffic without interfering with construction of additional structures, it was decided that the best solution was to build the 16 structures on the north platform during the construction phase.
In each of these areas, the structures are arranged in two rows, each of which is provided with a mobile roofing that can be moved along the installed rails.
These roofings support a 32-ton travelling crane for handling the containers. This is controlled from the Control Room.



F VI *Waste Conditioning Shop.*

That trucks that transport the storage containers are located in the lateral corridor between the storage structures and the roofing wall. Outside this there is an additional road. This width, which at first view is perhaps unnecessary, is required to cover the storage with the waterproof cover if the need arises, with suitably graded slopes. In addition, this zones contains the RCI control tank, the rainwater collection pool and the concrete plant for eventual construction of the southern platform structures and manufacture of the storage containers in the installation proper.

WASTE CONDITIONING

The operations performed in the Conditioning Building (fig. VI) are divided into five main groups:

WASTE FROM SMALL PRODUCERS

The treatment provided depends on its physicochemical composition and the possibl e presence of biological risks (Table I).
Means are provided for temporary classification and storage of this waste, as well as a small "hot" shop for manipulating it (eg. cutting) and for decontaminating small material.

COMPACTABLE WASTE

A press is provided with a thrust force exceeding 1,000 tons. The cans with compactable waste are unloaded with a travelling crane in a depository provided specifically for this type of package. They are then introduced in the compacting

F V *General Layout.*

T I

Aqueous	Transfer to the Center's active affluent system.
Biological solids	Incineration.
Organic liquids (firing liquids, dissolvents)	Incineration.
Miscellaneous solids	Transfer to compacting line.
Encapsulated sources	Immobilization with mortar and transfer to the inmmobilized package line.

equipment and subjected to controlled ventilation.
The pellets are put into a storage container before being sent to the mortar injection line.

IMMOBILIZED WASTE

The waste that arrives already conditioned in a solid matrix, usually cement, are transferred to the storage containers with the aid of a travalling crane. There are two similar bays for this type of waste, the only difference being the hoisting equipment. One is for packages with weak irradiation that arrive at the center without additional shielding, and the other is used for unloading packages that are transported inside an additional shielding due to their dose rates. This second bay has thicker shielding and is equipped with facilities for opening the outside wrapper and manipulating the lid.
In both cases, once the container is full, it is transferred to the container bay on a trolley. From here, once the lid is in place, the container is transported by the container bay crane to the mortar injection station.

WASTE GENERATED IN THE CENTER

LIQUID WASTE

Anticipated liquid wastes are aqueous solutions of low concentration and activity (below the characterization limit) that are collected in tanks located in the building basement.
The selected treatment system has a dual purpose:

— Not increase the volume of waste to be stored, and
— meet the objective of no dumping.

These liquid wastes are included in the immobilization mortar that fills the interstices between drums inside the container.
Thus, storage capacity is not decreased, and since much more water is required for preparing mortar than the expected quantity of liquiq effluents, the no dumping objective can be satisfied.

SOLID WASTE

The various solid wastes that may be generated will be treated as compactable waste.

MORTAR INJECTION

Once the lid is placed on all the containers, they are transferred to the immobilization mortar injection station. This station has two sections, one for filler mortar (in which very low activity liquid wastes can be incorporated) and another for special mortar for sealing the joints between container lid and body.
All the systems are operated with remote manual control from the Control Room, except for manipulation of wastes from small producers, which generally have bottom contact doses.

PROJECT DEVELOPMENT AND OBTAINING LICENCES

The site characterization work began at the beginning of 1986 on the basis of studies performed up to that time by CIEMAT. These studies were extended until 1989 to acquire a thorough knowledge of the site and, in particular, of its hydrogeology. It should be noted that more than 8,000 m of borings were made in the vicinity of the new installations.
Several organizations and firms participated in these studies, including CIEMAT, CGS, INTECSA, d'APPOLONIA, INGEMISA, ANDRA and BRGM.
Work began on the preliminary engineering documents in the second half of 1986 in collaboration with the French waste management agency, ANDRA. In May 1987, the installation project developed by INITEC was begun, with the French engineering firm Technicatome, as consultants.
The construction authorization application was submitted in May 1988 in accordance with the Nuclear and Radioactive Installation Regulations. As a novelty, it included an environmental impact study, in accordance with the Legislative Decree of 1986 on environmental impact evaluation.
A general revision of the mandatory documentation was submitted in April 1989 to include the waste reclaimability criterion, after several meetings with the Nuclear Safety Council and the General Directorate of Energy.
The municipal building permit was also requested in May 1989 from the Hornachuelos City Council.
In July 1989, the Nuclear Safety Council issued the mandatory report of approval, and in August the General Directorate of the Environment issued the Environmental Impact Declaration in coordination with the Nuclear Safety Council. This installation is the first industrial project subject to this declaration.
On November 2, 1989, the "Boletín Oficial del Estado" published the Construction Authorization Order dated October 31. On November 17, the Provincial Urban Planning Commission of Córdoba issued its report of approval of the requested development licence, and finally, on December 5, the Hornachuelos City Council granted the municipal permit, of which ENRESA was notified on December 13.
Currently, the general levelling work is in an advanced phase, and it is expected that concrete pouring of the main buildings will begin next May. Construction of the new center should be finished by the end of 1991, so that the installation can begin operating at the beginning of 1992.
Detailed engineering work also continues to support equipment procurement, construction and erection, as well as to execute the requirements of the conditional annexes to the construction authorization.
Likewise, the site studies continue in order to complete the requested information and demonstrate the suitability of the site for long-term storage of low activity waste.

CONCLUSION

Everyone is aware of the difficulties invoved in obtaining local permits for building a radwaste storage, regardless of whether it is a permanent or temporary storage or for high or low activity waste. Having successfully obtained all the required authorizations, including the regional and local ones, the anticipated storage capacity of 35,000 m^3 in 0.22 m^3 cans (or, to put it another way, 63,000 m^3 inside containers, or 103,000 m^3 inside storage structure) is a necessary benefit.
In our opinion, low and medium activity waste management, both by ENRESA and by the producers, should be aimed at optimizing the occupation level of this volume by applying reducing techniques and concentrating activities on currently used processes, without exceeding, of course, the limits of bundle acceptance criteria in this installation.